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# Village Creek Wastewater Treatment Plant

## Fort Worth Water Department

Village Creek Plant

# Introduction

Village Creek Wastewater Treatment Plant serves more than 750,000 people and numerous industries in 24 communities. This City of Fort Worth owned and operated plant is permitted and capable of processing 166 million gallons of wastewater each day.

The service area consists of most of Tarrant County and a portion of Johnson County. As part of the Dallas/Fort Worth metroplex, it is one of the largest and fastest growing areas in the United States that does not have a major waterway for disposal of treated wastewater.

Village Creek Wastewater Treatment Plant and other surrounding counties discharge treated effluent into the sensitive Trinity River. During dry months, the river may be composed of up to 95 percent wastewater making the Village Creek Plant performance critical to the Trinity's vitality and usefulness as a drinking water source for those downstream.

The biosolids produced from the treatment process (110 dry tons per day) are processed and stabilized to the highest level of treatment recognized by EPA -Class A , EQ (exceptional Quality) biosolids. 100% of the biosolids produced at Village Creek are beneficially reused/recycled by land application of area farm and ranch lands in Tarrant and eleven surrounding counties.

In 1988, the Environmental Protection Agency (EPA) recognized Village Creek as the best large advanced wastewater treatment plant in the country by awarding it the National EPA Operations and Maintenance Award of Excellence.

In addition, in 1998 and 1999 Village Creek earned the EPA national “honorable mention” award for an Outstanding Project involving and enhancing Beneficial Use of Municipal Wastewater Biosolids for a Large Operating Project.

## Pretreatment Services

Pretreatment Sampling

The City of Fort Worth's wastewater treatment program begins with the Pretreatment Services division. Pretreatment Services is responsible for monitoring and controlling wastewater pollution from commercial and industrial sources as authorized by a city industrial waste ordinance.

Wastewater enters the Village Creek Wastewater Treatment Plant from the City of Fort Worth and 23 wholesale customer cities. Pretreatment Services monitors this wastewater for toxic substances that could create a hazard in the sewerage system and/or inhibit or damage the plant's treatment processes.

Specifically, pretreatment staff work with noncompliant industries and wholesale customer cities within the framework of an enforcement response plan to reduce toxic substances discharged to the Village Creek Wastewater Treatment Plant. Semi-annually, all industries submit reports outlining their compliance status with ordinance and permit conditions of the pretreatment programs.

All pertinent industrial users within the area served by the plant are periodically surveyed. Significant industrial users are identified and issued wastewater discharge permits that limit substances that enter the sewer system. These industries are monitored and inspected both on a routine and random schedule.

## Wastewater Treatment Process

Village Creek Wastewater Treatment Plant uses the same purification methods found in nature—settling, filtration and biological activity. Plant design and operation allow the purification and stabilization processes to take place in a much smaller space, within a shorter time frame and at a lower cost. A summary of these processes is presented in the Village Creek Wastewater Treatment Plant Facility Description table at the end of this section.

The City of Fort Worth wastewater collection system consists of approximately 2,400 miles of sanitary sewer. The majority of the system is gravity flow; however, the City maintains 49 pump stations to service the lower lying areas within the basin. The wastewater enters the Village Creek Plant through two 96 inch sewer collector mains and one 54-inch collector main. As the wastewater enters the plant, chlorine is added to provide seasonal odor control. The flow volume is also measured using Parshall flumes.

The wastewater then goes through the bar screens—a row of closely and evenly spaced bars across the influent channel (¾-inch openings). The bar screens remove large objects that could block pipes or damage equipment. Bars are cleaned periodically with a mechanical rake and the material removed is taken to a sanitary landfill.

The City is constructing a new fine bar screen facility to remove more suspended solids at the headwork and reduce rag buildup in other treatment processes. The new facility is equipped with 6 mm fine screens, which are mechanically cleaned. Fine screens will also be placed on one bay of the existing bar screen number 3, and the remaining bays will be maintained for emergency use.

## Primary Treatment

Primary Clarifiers

After passing through bar screens, the wastewater goes to the primary clarifiers. In these large circular tanks, the wastewater flow is slowed to about one foot per minute so heavier solid materials can settle to the bottom. Grease and oil (scum) float to the surface and are removed and burned in an incinerator.

The solids that settle out (sludge) are scraped to the center of the clarifier (sedimentation tank) and pumped to the sludge degritting facilities for removal of sand and gravel. The bulk of the wastewater flows through the clarifier and is allowed to overflow the weirs for pumping to secondary treatment.

## Secondary Treatment

Aeration Basins & Final Clarifiers

Village Creek uses conventional activated sludge as the heart of its treatment process. A biological treatment begins, that mimics the processes used by nature for purifying lakes and streams.

The process principle is to biologically convert pollutants that will not settle into substances that will settle. The wastewater is mixed with bacteria rich "activated sludge" in large aeration basins. Compressed air is fed through fine bubble diffusers to provide the bacteria and other microorganisms with enough oxygen to support the biological process in the wastewater. In fact, the bacteria "eat" organic matter in the wastewater. The process is controlled to minimize biological "burning up" of organic material.

Dissolved and suspended impurities in the wastewater are incorporated into the activated sludge floc through adsorption (when solids stick to the surface of the bacteria) and absorption (when dissolved gases and solids are taken into the bacteria where they can be assimilated) by the microorganisms.

Then the mixture of treated wastewater and activated sludge from the aeration basins is transferred to final clarifiers, where gravity separates the microorganisms from the wastewater. The clarified wastewater again overflows the clarifier weirs and moves on to the effluent filtration phase.

Most of the settled activated sludge is returned to the aeration basins to continue the treatment process. The remainder is pumped to Waste Sludge Concentration. Scum floating on the surface of the final clarifiers is removed and incinerated.

## High Rate Clarifier

The City is currently constructing a High Rate Clarifier (HRC) to treat high flow situations. Whenever instantaneous flows to the facility headworks equal or exceed 255 MGD, wastewater will be diverted from primary treatment to the HRC and discharged directly to the facility's disinfection units. This will allow detention times in the primary and secondary treatment stages to remain constant while the excess wastewater is treated in the HRC. The HRC can treat 80 MGD.

The sludge generated by the HRC will flow to the gravity belt thickeners, also under construction, to remove excess water. The liquid is sent to secondary treatment, and the concentrated sludge is fed into the sludge blend tank.

## Effluent Filtration

Traveling & Deep Sand Bed Filters

The remaining solids suspended in the wastewater are removed by the passing of the wastewater through multimedia filters composed of gravel, sand and anthracite coal. Filters are cleaned periodically by "backwashing," or sending clean water backward through the filter to flush out impurities. During backwash the bed "expands" and media particles bump against each other, allowing the particles to be

washed away. Newer backwash filters use only sand and use a traveling bridge that continuously backwashes one small cell at a time.

Backwash water is moved to an equalization basin and fed at a constant rate to the backwash clarifier, where the solids settle out. Solids are transferred to Waste Sludge Concentration, as are solids from secondary treatment. Clarified backwash water is filtered again.

## Chlorination/Dechlorination

Chlorine Contact Chambers & Dechlorination Tanks

After effluent filtration, the wastewater enters the chlorine contact basins, where it is mixed with chlorine and held for 20 minutes for disinfection to occur. The chlorine kills most of the disease-causing viruses and bacteria that remain.

However, since chlorine and its byproducts are toxic to aquatic life, sulfur dioxide is added after chlorination to remove the chlorine residuals. Sulfur dioxide dissolves to form sulfite, which reacts immediately with chlorine to form harmless chloride ions. After chlorination and dechlorination, the wastewater looks very much like drinking water and is discharged to the Trinity River.

## Primary Sludge Degritting/Concentration

The sludge that settles to the bottom of the primary clarifiers goes to this area. First, heavy inorganic particles such as sand and gravel (grit) are removed using cyclone degritters. The grit is classified (washed) and moved by conveyors to dump trucks and sent to a sanitary landfill.

After degritting, sludge flows to gravity thickeners to remove excess water. The liquid in the thickener overflows a weir and is returned to secondary treatment, and the thickened sludge is fed to the anaerobic digesters after being mixed with other sludge in a blend tank.

## Waste Sludge Concentration

Village Creek Wastewater Treatment Plant uses dissolved air flotation thickeners (DAFT) to concentrate the waste activated sludge from the final clarifiers. Compressed air is inserted into a mixture of water and the waste sludge. Small bubbles of oxygen form on the sludge particles making them less dense than water causing the sludge to float to the surface of the thickener. The concentrated float sludge is removed by a skimmer and pumped to sludge blend tank. The clarified liquid (subnate) is returned to the secondary treatment area.

## Anaerobic Digestion / Stabilization

Anaerobic Digesters & Dissolved Air Flotation Tanks (DAFTS)

The blended sludge is fed to the anaerobic digesters from the blend tank. Anaerobic digesters provide an environment where anaerobic bacteria (bacteria that cannot live with oxygen present) are able to thrive and can break down the organics in sludge into stable compounds.

Anaerobic digestion reduces solids, odors and pathogens, and it conditions sludge so it dewaters rapidly. Methane gas, produced as a byproduct of this process, is used for mixing the digesters. This gas is recycled into fuel for incinerators, generating electricity and compressed air for the aeration basins.

## Odor Control

Covered Thickeners, Bio-filters & Air Scrubbers

Village Creek is located near a growing residential area, and controlling odors generated by the plant is a high priority. Many of the treatment processes, such as bar screening and cyclone degritting, are enclosed in air-scrubbed buildings. The primary sludge thickeners, waste sludge DAFT thickeners and the weirs of the primary clarifiers are also covered and scrubbed. Village Creek uses both wet scrubbers and carbon adsorption scrubbers. Other odor control measures include the addition of chlorine to incoming wastewater, optimization of treatment processes and maintenance of good housekeeping around the plant.

# Village Creek Wastewater Treatment Facility Description

| Plant Loadings | | | Filtration | |
|---|---|---|---|---|
| Rated capacity, MGD | 166 | | Dual-media gravity filters | 20 |
| Average daily flow, (2004), MGD | 107 | | Continuous backwash filters | 12 |
| **Discharge Standards** | | | **Disinfection** | |
| CBOD, MG/L | 7 | | Chlorination contact time, minutes | 20 |
| Total suspended solids, MG/L | 15 | | Dechlorination | |
| **Discharge Performance (2004)** | | | Volume in MGD | 166 |
| Average BOD, MG/L | 2 | | **Sludge Processing** | |
| Average total suspended solids, MG/L | 2 | | 65-foot diameter primary sludge thickeners | 4 |
| **Pretreatment** | | | DAFT thickeners | 4 |
| Bar Screen Units | 12 | | 80-foot diameter anaerobic digesters | 2 |
| **Primary Treatment** | | | 90-foot diameter anaerobic digesters | 12 |
| 80-foot diameter clarifier | 12 | | Sludge drying beds ( Standby ) | 200 acres |
| 160-foot diameter clarifier | 6 | | **Contract Dewatering** | |
| **Secondary Treatment** | | | Belt Filter Presses (2 meter ) | 4 |
| *Conventional activated sludge w/fine bubble diffused air* | | | Liquid Sludge Holding Tanks | 2 |
| | | | Lime Storage Silo & Pug mill | 1 |
| | | | Trucks | 8 |
| *Aeration basins* | | | **Centrifugal Blowers** | |
| 3.41 million gallons | 6 | | 50,000 cfm electric blower | 1 |
| 3.37 million gallons | 3 | | 25,000 cfm electric blowers | 5 |
| 3.37 million gallons | 3 | | 31,000 cfm engine blowers | 2 |
| 1.54 million gallons | 4 | | **Generators** | |
| *Final clarifiers* | | | 1250 KVA | 2 |
| 150-foot diameter | 9 | | | |
| 130-foot diameter | 4 | | **Turbines** | |
| 110-foot square | 2 | | 5.2 MegaWatt | 2 |
| 95-foot diameter | 6 | | | |

# Biosolids Beneficial Reuse

## History

The Fort Worth Water Department has always been dynamic and progressive in the area of beneficial reuse of sludge (biosolids). The Village Creek Wastewater Treatment Plant staff is proud to continue the tradition that the City of Fort Worth has never land filled its sludge (biosolids).

Beginning with the opening of the first Wastewater Treatment Plant (Riverside) in 1923, and continuing today with Village Creek Wastewater Treatment Plant (1953 to present) "air-dried" biosolids from lagoons and the drying bed areas were beneficially reused until the late 1980's on area highway easements and medians as a soil amendment and fertilizer through agreements with the Texas Department of Transportation. City parks, city golf courses and the city nursery also used biosolids fertilization to sustain and enhance grass and tree growth.

Due to population growth, plant expansion and implementation of new regulatory requirements in the late 1980's, the Water Department began looking at other processes of sludge dewatering (mechanical) and the proper disposal by beneficial reuse. Since the North Texas area, is surrounded by farm and ranch lands, mechanical dewatering by belt-filter press and "beneficial reuse/recycling" of biosolids by land application was found to be the most cost effective.

In 1991, Village Creek "privatized" 40 percent of the solids dewatering (by belt press), transportation and beneficial reuse of biosolids by land application through a contractual agreement. Due to the success and public acceptance of the program, subsequent contracts were issued with increasing amounts of biosolids. Beginning in April 1995, the City and Contractor entered into a "Long-Term" contract to dewater by belt press, process, transport and beneficially reuse 100% of the plant's biosolids production.

## Biosolids Dewatering (Belt Filter Press)

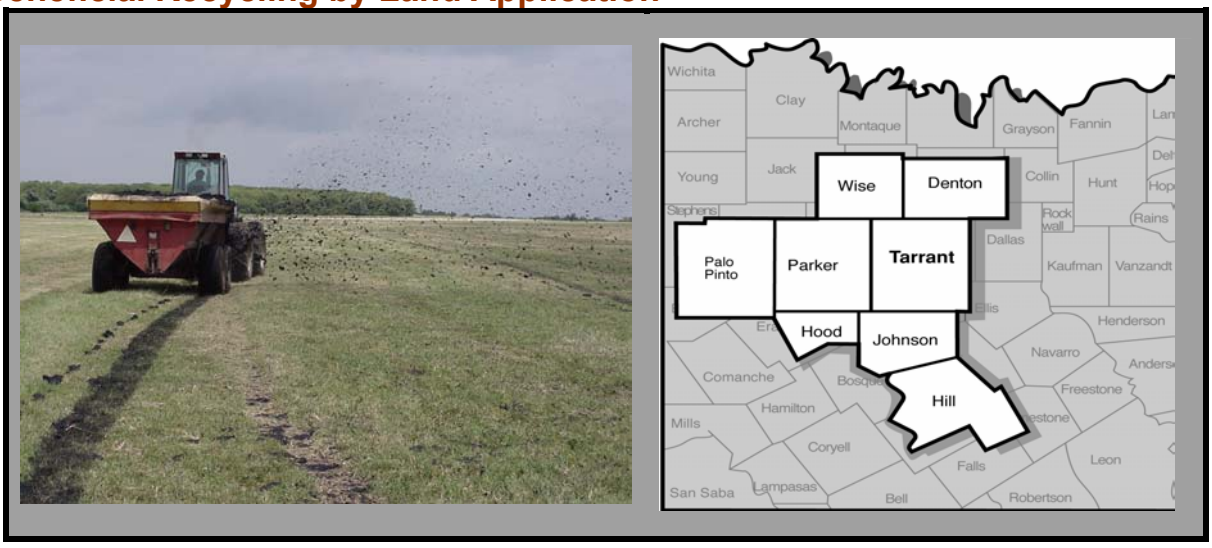
Belt Filter Presses & Liquid Sludge Storage Tanks

Beginning in April 1995, 100% of the Plants digested sludge (biosolids) is pumped at 3% solids to the Dewatering Facility, located one mile north of the Plant at the Sludge Only Landfill (SOL) site. At the Dewatering Facility a private contractor operates and maintains belt filter presses to mechanically dewater (press and squeeze moisture out of) the biosolids. Polymer is added to condition the biosolids and aids in the dewatering process. The processed and dewatered biosolids (21% to 27% solid) are conveyed to a pug mill where lime is added to the biosolids to achieve a ph of 12.0 for two hours to further stabilize the biosolids.

## Class “A” Biosolids

Since 1995, Village Creek has produced the highest quality stabilized biosolids **(Class A**, **EQ-exceptional quality)** recognized by the Environmental Protection Agency and the Texas Commission on Environmental Quality. **Class “A”** biosolids results from the combination of excellent pretreatment, full anaerobic digestion (25 days at 97 degrees C) and post-lime stabilization. The **Class “A”** biosolids are 100% beneficially reused as a fertilizer and soil conditioner.

## Beneficial Recycling by Land Application




The biosolids produced at Village Creek during wastewater treatment (110 Dry Tons per Day) are 100 percent beneficially reused/ recycled as a fertilizer and soil amendment by land application on allowable farm and ranch land in Tarrant and seven (7) surrounding counties. A private contractor transports and land applies the Class “A” biosolids at “agronomic rates” on cropland and pasturelands. More than 60+ landowners with more than 40,000 registered and noticed acres participate in the Fort Worth Biosolids program. There is a 60-day waiting list for biosolids fertilization.

| FORT WORTH WATER DEPARTMENT<br>"BENEFICIAL RECYCLING" of CLASS "A" BIOSOLIDS PROGRAM | | | | | |
|---|---|---|---|---|---|
| **Counties** | **Land-Owners** | **Noticed Sites** | **Noticed Acres** | **TOTAL Acres** | **(%) of Total Acreage** |
| Denton | 2 | 3 | 373 | 373 | 0.90% |
| Hill | 10 | 20 | 3,113 | 3,113 | 7.48% |
| Hood | 1 | 1 | 251 | 251 | 0.60% |
| Johnson | 20 | 30 | 5,577 | 5,577 | 13.40% |
| Palo Pinto | 2 | 2 | 4,035 | 4,035 | 9.70% |
| Parker | 3 | 13 | 17,337 | 17,337 | 41.66% |
| **Tarrant** | **15** | **22** | **3,918** | **3,918** | **9.42%** |
| Wise | 10 | 14 | 7,010 | 7,010 | 16.85% |
| **TOTAL 8** | **64** | **104** | **41,614** | **41,614** | **100%** |

## Biosolids Quality (EQ – Exceptional Quality)

The Water Department has a quality Industrial Pre-Treatment Program that is nationally recognized by EPA. The Pre-Treatment program permits and monitors all industrial, manufacturing and restaurant discharges, which reduces and eliminates many of the potentially harmful pollutants prior to entering the collection system. Over the years, trace metal concentrations, which have always been extremely low, have steadily decreased because of excellent pretreatment.

Exceptional Quality "EQ" biosolids are classified by EPA as biosolids with trace metal concentrations less than the metal limits (Table 3) established by EPA under the 503 Federal Sludge Regulations.

| VILLAGE CREEK WASTEWATER TREATMENT PLANT<br>METAL CONCENTRATIONS in BIOSOLIDS<br>BY CALENDAR YEAR (Jan. thru Dec.) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **YEAR 1991 - 2004** | **Ar** mg/kg | **Cd** mg/kg | **Cr** mg/kg | **Cu** mg/kg | **Pb** mg/kg | **Hg** mg/kg | **Mo** mg/kg | **Ni** mg/kg | **Se** mg/kg | **Zn** mg/kg | Pathogen Requirement Achieved | **Pathogen Reduction** Alternative Used | **Vector Attraction Reduction** Alternative Used | **PCB** |
| **NPDES Permit Limits (TABLE 3)** | **41** | **39** | **1200** | **1500** | **300** | **17** | **N/A** | **420** | **36** | **2800** | **n/a** | **n/a** | **n/a** | |
| | Monthly Average Concentration (mg/kg)) | | | | | | | | | | | | | |
| 1991 | 0.0 | 21.2 | 182 | 327 | 62.9 | 0.00 | 0.0 | 38.5 | 0 | 576 | Class B | PSRP | 6 | |
| 1992 | 0.0 | 16.2 | 174 | 336 | 63.7 | 0.00 | 0.0 | 32.7 | 0 | 728 | Class B | PSRP | 6 | |
| 1993 | 10.6 | 11.9 | 194 | 391 | 69.1 | 0.31 | 0.1 | 36.7 | 1.23 | 895 | Class B | PSRP | 6 | |
| 1994 | 14.5 | 8.7 | 131 | 315 | 50.9 | 0.70 | 0.0 | 31.4 | 2.41 | 761 | Class B | PSRP | 6 | |
| 1995 | 0.2 | 1.1 | 30 | 70 | 18.8 | 0.05 | 0.0 | 2.9 | 2.67 | 159 | Class A | 4 | 6 | ND |
| 1996 | 5.3 | 0.5 | 33 | 68.9 | 14.9 | 0.36 | 0.0 | 7.6 | 2.55 | 137 | Class A | 4 | 6 | ND |
| 1997 | 3.6 | 0.1 | 29 | 67.3 | 13.2 | 0.22 | 0.0 | 6.6 | 1.00 | 128 | Class A | 4 | 6 | ND |
| 1998 | 0.0 | 0.5 | 25 | 74.1 | 4.4 | 0.13 | 0.3 | 6.9 | 2.83 | 131 | Class A | 4 | 6 | ND |
| 1999 | 1.4 | 0.4 | 22 | 80.4 | 10.1 | 0.24 | 5.1 | 8.3 | 0.84 | 138 | Class A | 4 | 6 | ND |
| 2000 | 2.6 | 0.7 | 28 | 75.1 | 10.2 | 0.21 | 4.3 | 9.1 | 0.33 | 356 | Class A | 4 | 6 | ND |
| 2001 | 3.8 | 0.4 | 18 | 78.3 | 9.9 | 0.20 | 5.0 | 5.8 | 1.06 | 422 | Class A | 4 | 6 | ND |
| 2002 | 0.9 | 0.9 | 10 | 78.6 | 8.2 | 0.07 | 4.9 | 4.5 | 1.44 | 169 | Class A | 4 | 6 | ND |
| 2003 | 0.6 | 0.4 | 11 | 76.7 | 5.9 | 0.02 | 7.2 | 5.1 | 1.08 | 135 | Class A | 4 | 6 | ND |
| 2004* | 0.8 | 0.0 | 8 | 84.7 | 3.6 | 0.00 | 4.9 | 4.5 | 0.44 | 132 | Class A | 4 | 6 | |
| 2005 | | | | | | | | | | | | | | |
| Average Metals Concentration | **3.2** | **4.5** | **64** | **151.7** | **24.7** | **0.18** | **2.3** | **14.3** | **1.28** | **348** | **Class A** | **4** | **6** | **ND** |

* - Partical Year (3 months)

## Public / Private Partnership

Since 1991, Village Creek Wastewater Treatment Plant partners with Renda Environmental Inc., a private contractor, to provide 100 percent beneficial reuse/recycling of all biosolids produced. This positive and long-term public/private partnership facilitates joint problem solving, cohesive communication and dedication to safe biosolid recycling.

FORT WORTH

RENDA ENVIRONMENTAL

## Benefits Of Biosolids Fertilization

Agricultural users of Fort Worth Biosolid fertilization have observed and documented:

Increased hay and crop production
Enhanced Crop and forage quality
Improved and Enhanced soil conditions
Increased soil organic matter aggregation, plant rooting and soil tilth
Increase in cow/calf grazing pressure
Higher total digestible nitrogen content
Decreased soil erosion
Increased nutrient availability throughout crop growing season

## Sludge Drying Beds

Drying Beds & Wildlife

Approx. one mile northeast of the Village Creek Wastewater Treatment Plant, lie 240 acres of sludge drying beds. From 1970-1995, the drying beds were the final dewatering step (by natural air-drying) in solids processing. Each summer the biosolids (sludge) were removed from the beds and beneficially reused/recycled as a fertilizer and soil conditioner on area parks, golf courses, highways easements and farmlands. In April 1995, Village Creek ceased pumping biosolids (sludge) to the drying beds. The biosolids that remained in the drying beds and adjacent stockpiles were removed and beneficially reused as a fertilizer and soil amendment under a series of contracts from 1996-2001. *In October of 2001, all biosolids (sludge) was removed from the drying beds and the contracts were completed.* The drying bed site is currently maintained and available as an emergency backup for sludge storage, as outlined in the City's master plan.

Another unique feature of the Village Creek sludge drying beds are the abundance of birds and wildlife that have been attracted to the area over the years. The nutrient-filled water teems with organic life that appeals to a variety of birds. The birds and other wildlife have been using the area for over 30 years as a feeding and nesting area. Due to the availability of water and the remoteness of the site, the area is also a resting stop for migratory birds on the Central Flyway of the United States.

## Energy Recovery/Recycling

## Recycling

Village Creek is dedicated to using its resources efficiently, and that includes recycling energy as well as biosolids recycling. Methane gas produced during anaerobic digestion is captured and used to generate electricity on site and to power blowers that provide air for the aeration basins.
About 90 percent of the energy required for aeration is produced by the generated power. Overall, 40 percent of the total plant's energy requirements are produced through the use of methane gas. Waste heat from the system is used to heat digesters that produce methane. Future construction will increase the energy produced from methane to more than 75 percent of the plant's total electrical needs.

The City contracts with a private company to operate new turbine engines used to generate electricity for the plant. Any excess electricity generated is sold to the local electric gird. In order to maximize electricity production, a pipeline was constructed to bring additional methane gas to the turbines from a nearby landfill.

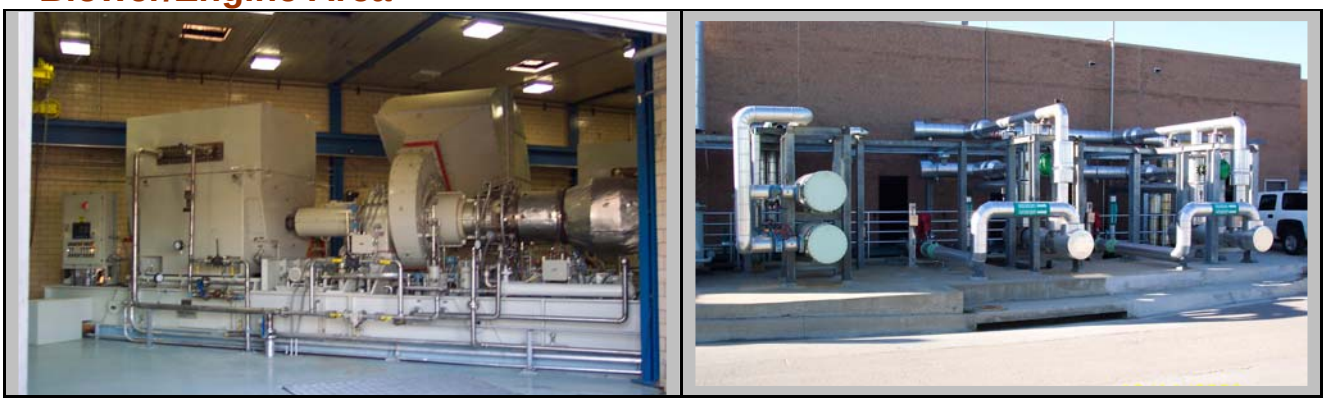
## Energy Recovery and Controls

Listed below are the specific areas where energy is recovered during the wastewater treatment process.

## Scum Incineration

All floating materials from the various treatment processes are moved to the scum holding tanks, then burned in a gas fired water grate incinerator.

## Blower/Engine Area



Bio-Gas Turbines

Two 5.2 megawatt gas turbine engines produce electricity for use throughout the plant and drive blowers that provide compressed air to the aeration basins. The engines can be run on digester gas, natural gas, landfill gas, or diesel fuel.

## Process Control

The plant's processes are controlled through the plant process computer system, manually through control stations in the control room or manually in the field. Flows are split between the different process units, and a few pieces of equipment are started or stopped remotely as needed based on conditions occurring in the treatment processes and the results of lab data. Multiple computers are networked to provide for distributed controls (DCS) and operator interface. Process controls are available to many offices via the office network, which connects all portions of the Water Department.

The central control system acts as a focal point of plant operations. CRT displays provide windows into the plant process, offering operators opportunities to compensate for changes in plant processing and select control strategies while computers are left with the mundane tasks of making continual adjustments for control. The process computer also provides for equipment monitoring, alarming, data logging, database and statistical reporting.

## Village Creek Wastewater Support Sections

### Laboratory

Laboratory Sampling & Analysis

The Water Department's Laboratory Services Division analyzes wastewater and sludge samples collected throughout the day from all treatment phases. Staff chemists and microbiologists use automation to help analyze wastewater samples. Results are used for process control, monitoring treatment effectiveness and reports to regulatory agencies.

Analyses include metals and priority pollutants in the influent, effluent and sludge; microbial counts, oil and grease; organics and inorganics; dissolved oxygen and suspended solids in the aeration basins; and anaerobic digester activities for methane gas production.

### Wholesale Customer Metering

Metering Station & Equipment

A total of 24 communities and authorities and 85 percent of the total customer flow is metered with remote polling into computer databases. Sixteen customers are metered for billing purposes.

Rain gauges have been installed at 27 of the 40 metering locations to determine how wastewater flow rates are affected by rainfall. The City of Fort Worth Wet Weather Management Program Office uses Telog software and database for sewer modeling.

Staff members have tested flow meters and other instrumentation to determine accuracy and reliability for future capital outlay requests.